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LISTS OF SPECIES

A floristic study on herbs and climbing plants at Puducherry, South India: An approach to biodiversity conservation and regeneration through eco-restoration

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ABSTRACT: A qualitative floristic exploration with life form classifications and monitoring of flowering and fruiting phenology has been carried out at a restored site near Puducherry, South India in 2009 and 2010. The species were classified into three categories based on their occurrence status, namely, Naturally Occurring, Naturally Regenerated and Introduced. The present study focuses only on two life forms, the Herbaceous and the Climbing plants. The site selected for eco-restoration originally comprised of an eroded and severely degraded landscape with scattered remnant species. However, active human intervention over a thirty year period included the introduction of appropriate plant species and other physical measures to enhance soil fertility and ground water level, and regenerate and conserve the deteriorating typical Tropical dry evergreen forest (TDEF) vegetation. A large number of naturally ccurring herbaceous, climbing species (172) and a consistent number of naturally regenerated species (44) are now observed as a result of eco-restoration. Lowland herbaceous species have also established themselves as a green cover at ground level. At present, parts of the area have fertile soils and rich floristic composition with the herbaceous life form represented by 165 species encompassed in 105 genera and 37 families, and the climbing plants represented by 68 species belonging to 54 genera and 25 families. 'Genus to family' and 'species to genus' ratios indicate the establishment of diverse vegetation in the study site. Nearly one third of the species have been observed flowering throughout the year and about half of the species were observed fruiting throughout the year. We emphasize that the two fold approach of land and vegetation reclamation has been very effective in helping restore the unique TDEF vegetation at the local level and the same may be extended to help regenerate and conserve the Coromandel Coastal vegetation at the regional scale.

INTRODUCTION

India occupies only 2.4% of the world's geographical area, but is endowed with a variety of bedrocks, soils, climates, flora and fauna. It represents a wide range of ecological diversity (Gupta *et al*. 2006). Around 69% of India's total geographical area (about 328 million hectares, further abbreviated as mha) is classified as arid (15.8%), semi-arid (37.6%) or dry sub-humid (16.5%) (Ajai *et al*. 2009). The Ministry of Environment and Forests of the Government of India has reported that 107.4 mha of the total geographical area is affected by desertification (MOEF 2007). About 72.1% of existing forests have lost the capacity for natural regeneration (Rai and Saxena 1997). In India, waste lands account for nearly 55.6 mha while 32.8 mha forests are degraded or open, but could be made fertile again if treated properly through eco-restoration (MOEF 2007; National Remote Sensing Centre (NRSC) and Ministry of Rural Development 2010).

'Eco-restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed' (Society for Ecological Restoration International Science and Policy Working Group 2004). In the present scenario, land and vegetation have deteriorated severely by high anthropogenic pressure that has led to unpredictable changes in the environments, eventually increasing the socio-economic crises. Hence high priority is needed for their conservation. The International Coordinating Council for Man and the Biosphere (MAB), a programme of UNESCO in 1986, approved four new research orientations as approaches to ecosystem rehabilitation (Schreckenberg *et al.* 1990): (1) Ecosystem functioning under different intensities of human impact, (2) Management and restoration of human-impacted resources, (3) Human investment and resource use and (4) Human response to environmental stress. In this context, we surveyed the vegetation cover in a site that has been restored through active human intervention during the past thirty years. The importance of herbaceous strata is all the more critical in a hitherto completely denuded landscape, and thus formed our primary focus, emphasized in this paper.

Herbaceous vegetation plays an important role in nutrient conservation and as a source of food for herbivores (Yadav and Gupta 2007). The traditional use of climbing herbs still continues by ethnic communities. The variation in the richness and diversity of lianas in tropical forests has been taken into account (Gentry and Dodson 1987; Muthuramkumar and Parthasarathy 2000, Balfour and Bond 1993) though the biological basis for this remains little or poorly understood (Caballe and Martin 2001). Various studies on liana diversity and distribution in different areas such as the Western Ghats, Eastern Ghats and Coromandel Coast of peninsular India

highlighted anthropogenic pressures as a severe causal factor and afforestation as a priority especially needed in the Tropical dry evergreen forest (TDEF) of Coromandel Coast (Parthasarathy and Karthikeyan 1997; Sridhar Reddy and Parthasarathy 2003; Selwyn and Parthasarathy 2006; Muthumperumal and Parthasarathy 2009). The fact that our restored study site currently consists of a mosaic vegetation highlights the uniqueness of this check list that also tabulates actual observed reproductive phenology during the two years study period.

Phenology, the study of relationship between climatic factors and periodic biological phenomena in organisms, provides knowledge on the pattern of plant growth and development and selective pressures on flowering and fruiting behaviour (Opler *et al*. 1980; Zhang *et al*. 2006). Flowering of many herbaceous plants is influenced by environmental stimuli, mainly photoperiod and low temperature. Rainfall variability also plays an important role in the induction and length of flowering phenology (Sivaraj and Krishnamurthy 1989; Rivera and Borchert 2001; Borchert *et al*. 2004). Kramer (1997) stated that phenology and climate relationship can reveal the potential impacts of climate changes.

Ecological (Champion and Seth 1968; Blasco and Legris 1973; Meher-Homji 1973, 1974; Parthasarathy and Karthikeyan 1997; Ramanujam and Kadamban 2001; Sridhar Reddy and Parthasarathy 2003), taxonomical (Kadavul *et al*. 2004a, b; Ramanujam *et al*. 2007; Udayakumar and Parthasarathy 2010) and ethno-botanical (Parthasarathy *et al.* 2008) studies have been carried out in the surroundings of the study area which comprises a rich and diversified vegetation, termed as TDEF showing high bio-resource values that are being fragmented severely by anthropogenic pressures and all these authors have emphasized conservation as a high priority. The added value of the floral checklist presented here stems from its uniqueness in representing a successful thirty year eco-restoration effort as well as the broad spectrum of vegetation types characterizing Puducherry and its surrounding areas.

Materials and Methods

Study site

The studied site (11°57'8.3"N, 79°45'57.2"E, and 40-50 m a.s.l.) spreads over 160 ha on the Eastern shore of the fresh water Ousteri Lake and about 10 km West of Puducherry city (Figure 1). Of the total study area, 40 ha is characterized as Cuddalore sandstone formation with red ferralitic soil. This red terrain is highly eroded as evidenced by the stratified walls of gullies and pebbles of various sizes and shapes (Figure 2). The rest of the area is characterized by clay, sand and silt soils and a few places are alkaline in nature. In the last thirty years (1981 - 2010), total mean annual precipitation of 1371 ± 354 mm (max= 2043, min= 845, median= 1333) and 56 ± 10 rainy days (max= 82, min= 37, median= 56) have been recorded. The rainfall is highly seasonal, with 63% of total precipitation occurring between October and December. During the past 6 years, as per our field records, rains occurred mainly in the nights. The monthly mean maximum and minimum temperature were 36.4°C and 21.6°C in June and January respectively (Figure 3). Six to eight months of the year are dry. Puducherry region has no major forest or hills, but has small patches of TDEF elements, deciduous forests, scrub jungles, sacred groves and mangroves. Coastal wetland species are also found here.

The original site comprising an eroded and severely degraded landscape with scattered remnant species was taken up for eco-restoration, maintaining a "control plot" reflecting the condition, thirty years back (Figure 2A - D). Eco-restoration comprised active human intervention through the introduction of drought tolerant soil nitrogen fixing species and TDEF elements; along with native pollinators, especially *Apis cerana* Fabricius that were found in the canyons of the original fragmented landscape; construction of check-dams along the gullies to prevent the soil erosion and conservation of rainwater to increase the soil fertility and ground water level; simultaneous development of nurseries for propagating the collected seeds and seedlings from various regions helped increase the diversity and richness of vegetation. As a result, the introduced TDEF species have established themselves and have naturally regenerated along the thickets in the past thirty years (Figure 2G). Lowland herbaceous species have also established themselves as a green cover at ground level, and soil texture has been transformed and the fertility increased.

Data collection

A qualitative floristic exploration has been conducted in 2009 and 2010. Sampling was carried out on alternate

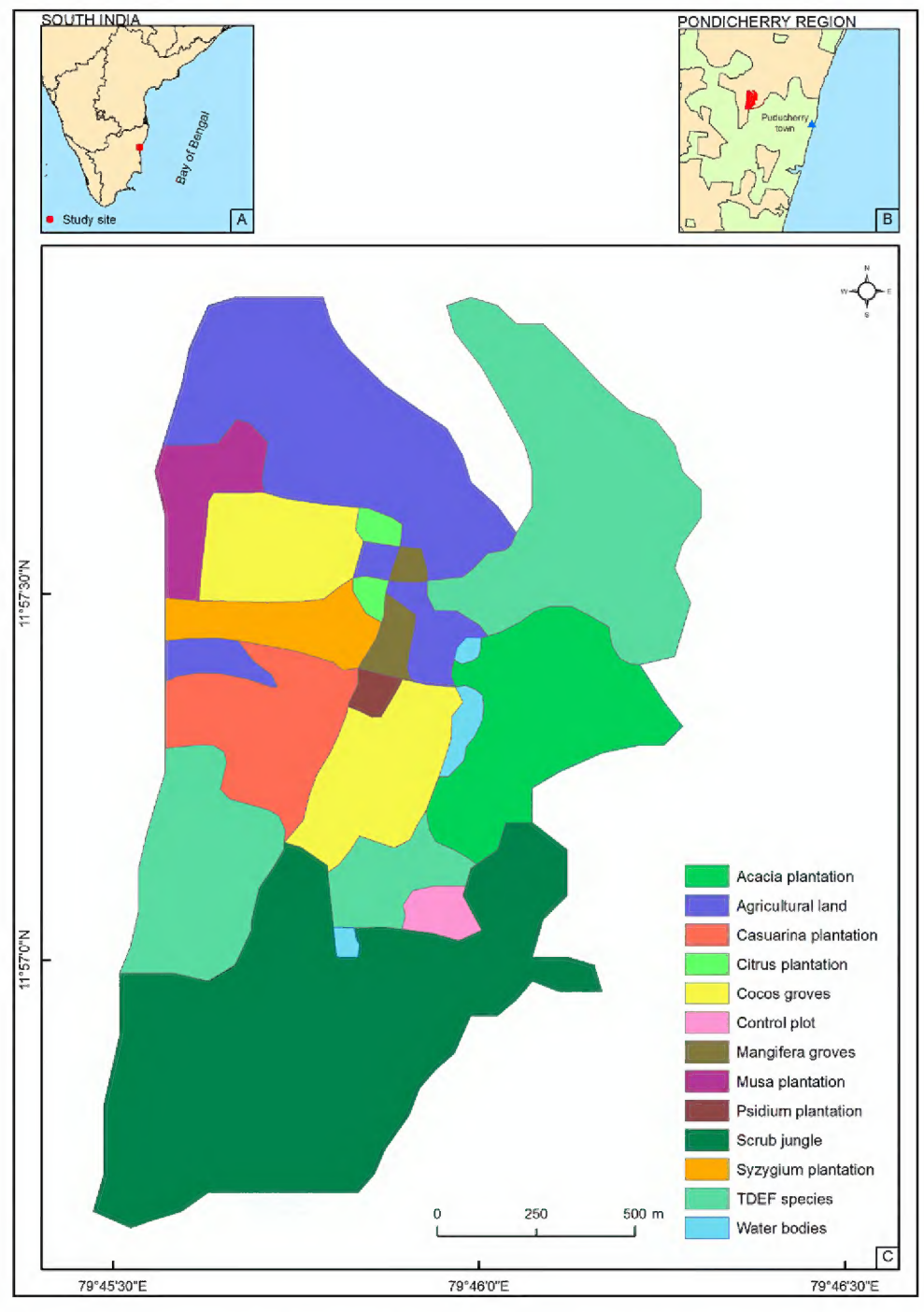


Figure 1. Study area, locating the site and its vegetation mosaic: A. south India; B. Pondicherry region highlighting study site and C. Vegetation of study site.

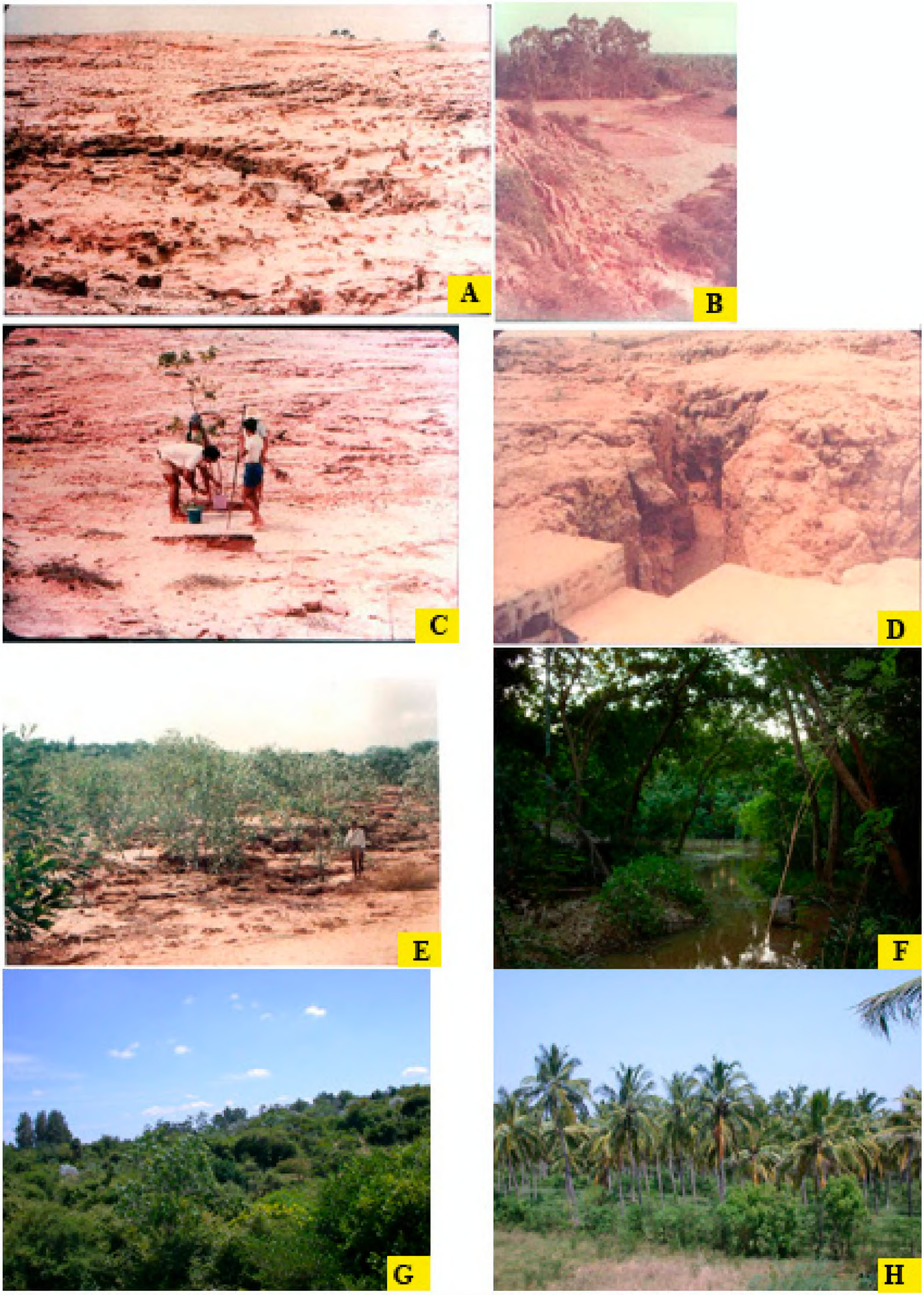


Figure 2. Land reclamation, conservation and regeneration of vegetation through eco-restoration: A. Degraded Landscape; B. Eroded Landscape; C. Planting of *Samanea saman*; D. Construction of check dam; E. Greening the landscape with *Acacia* spp.; F. Regenerated forest and rainwater harvesting; G. Established TDEF species in restored forest; H. Inter cropping in *Cocos nucifera* grove, photos by Project Ecolake.

days. All the species observed were collected and duly identified with the help of local floras (Bentham and Hooker 1862 - 1883; Gamble and Fischer 1915 - 1935; Matthew 1981 - 1983; Nair *et al*. 1983; Henry *et al*. 1987; Henry *et al*. 1989) and authentic herbaria. For all plant species documented, the binominal and author citation have been checked with International Plant Name Index (IPNI) in 2009. Voucher specimens were deposited in the Herbarium of the French Institute of Pondicherry (HIFP). Flowering and fruiting phenology were monitored and life forms were also categorized simultaneously according to their habits. The species were then classified, based upon their occurrence status (OS), into three categories namely 1. Naturally Occurring (NO), referring to species growing naturally thirty years back when the eco-restoration started; 2. Naturally Regenerated (NR), those species which established themselves during restoration and 3. Introduced (IN) are the species selected and planted for restoration. The list of NO plant species is based on a survey done beginning in 1979 with the help of botanists of the French Institute of Pondicherry (Prakash Patel 1999 - 2000). The binomial and author citations, life forms, occurrence status, reproductive phenology and available Tamil names of the species observed are presented in Table 1. For most of the species, a complete photographic documentation is also presented (Figures 4-35).

Results and Discussion

Floristic composition

In the overall floristic survey, seven life forms, namely Herbs, Trees, Shrubs, Climbers, Grasses, Sedges and Epiphytes have been recorded. The present study focuses only on Herbaceous (H) including prostrate, procumbent, spreading herbs, sub-shrubs and under shrubs and Climbing life forms (C) including tendril and non-tendril climbers, vines, runners, lianas, stragglers, ramblers and twiners. Altogether 233 species belonging to 157 genera and 56 families were enumerated (Table 1 and 2); this comprised 165 species belonging to 105 genera and 37 families under herbaceous life form and 68 species belonging to 54 genera and 25 families under climbing plants. The present study includes 56 of the 206 families proposed in Bentham and Hooker (1862 - 1883) system of classification with subsequent modifications as in the flora of Tamil Nadu (Nair *et al*. 1983; Henry *et al*. 1987; Henry *et al*. 1989). The high resolution photographic documentation of 190 species, arranged in alphabetical order of families then by species (Figures 4-35) will facilitate field identification, as such documentation, especially for herbs which are pictorially less represented so far. Tamil vernacular names are provided in this check list with a view to make this available to the non-specialist also.

The actual number of herbs and climbers recorded in the present study *vis à vis* their occurrence in Puducherry and the Southern Coromandel Coastal region have been systematically compiled and summarized in table 3 from published literatures (Parthasarathy and Karthikeyan 1997; Sridhar Reddy and Parthasarathy 2003; Kadavul *et al*. 2004a, b; Ramanujam *et al*. 2007; Parthasarathy *et al*. 2008; Padmavathy *et al*. 2010; Udayakumar and Parthasarathy 2010); the table also provides information on the actual numbers of species, genera and families reported in each of the studies and details the respective site detail. We have compiled this table in order to highlight the conservation value of the eco-restoration carried out in our study site at a regional level. About 50% of species listed in these earlier works, spread over

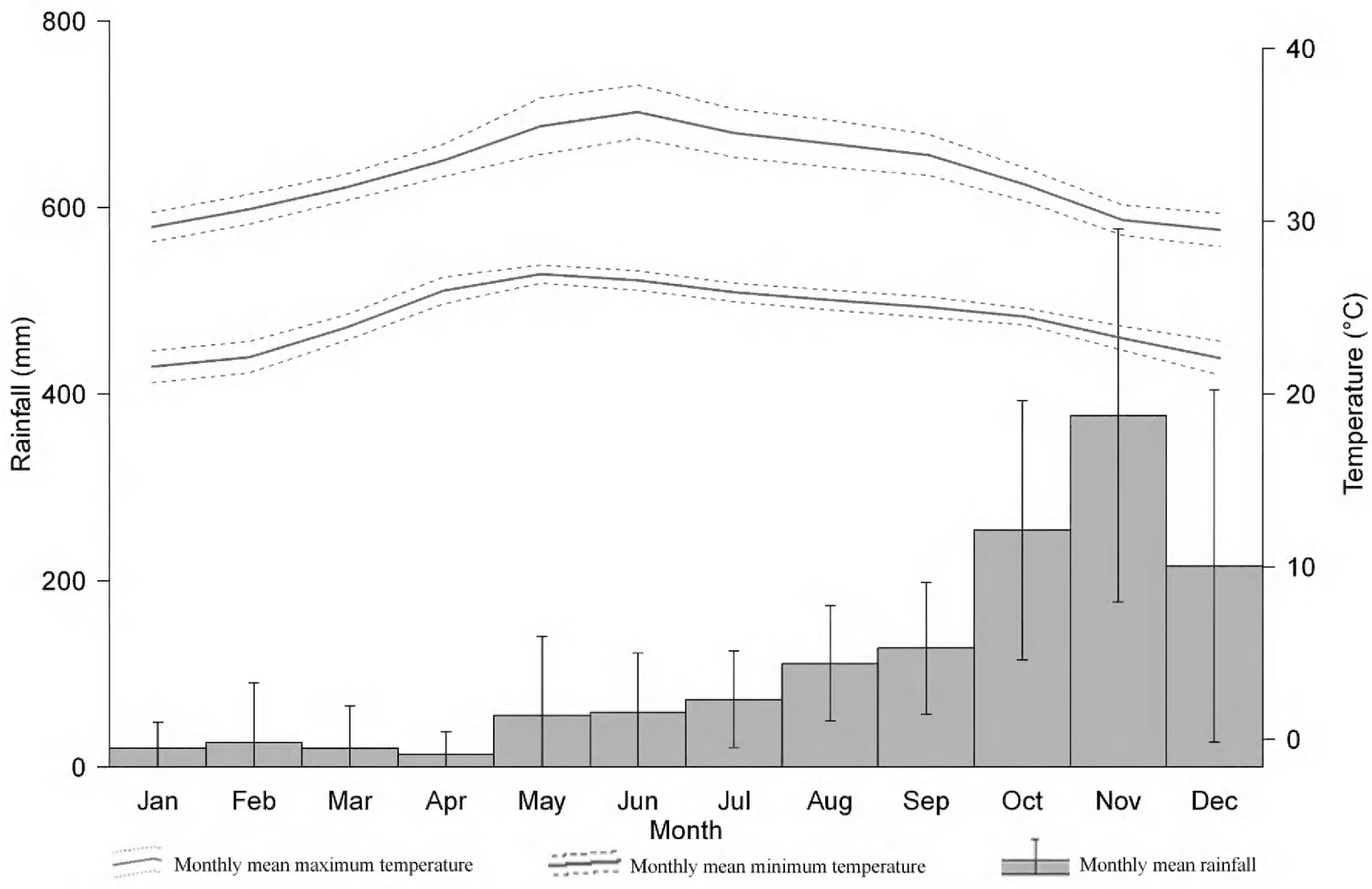


Figure 3. Pattern of thirty years (1981-2010) monthly total rainfall and monthly mean maximum and mean minimum temperature.

a wider geographic area, were enumerated in the present study site.

Out of the herbs and climbers observed, Fabaceae is well represented with the largest number of genera (19) and species (31), followed by Asteraceae (14, 17), Euphorbiaceae (7, 16), Amaranthaceae (11, 14), Acanthaceae (10, 12) and Convolvulaceae (6, 12); these six dominant families together comprise ~ 44% of the species in the two life forms reported here. The present study is in conformity with the earlier works of Ramanujam and Kadamban (2001), who have enumerated 169 angiosperms species around Puducherry and reported Fabaceae as the most speciose family in this area. Padmavathy *et al*. (2010) reported single species occurrence in 14 families. In our study, single species occurrence was found in 21 families and 116 genera. The three Monocotyledones families observed include 5 genera each with only one species per genus (Table 2).

The overall 'genus to family' (G/F) ratio in the present study is observed to be 2.80 ± 3.54 (max= 19, min= 1, mean= 2.80 and median= 1), it is 2.84 ± 3.43 (max= 14, min= 1, mean= 2.84 and median= 1) for herbaceous and 2.16 ± 2.08 (max= 8, min= 1, mean= 2.16 and median= 1) for climbing life forms. Similarly the 'species to genus' ratio (S/G) is marked by 1.48 ± 0.97 (max= 6, min= 1, mean= 1.48 and median= 1) for all species observed. It is observed to be 1.57 ± 1.05 (max= 6, min= 1, mean= 1.57 and median= 1) for herbs and 1.26 ± 0.71 (max= 4, min= 1, mean= 1.26 and median= 1) for climbing plants. It means that relatively diverse vegetation is established in the study site, as suggested by Pielou (1975) and Magurran (2004) who opine that, in intuitive terms, hierarchical (taxonomic) diversity will be higher in an area in which the species are divided amongst many genera as opposed to one in which most species belong to the same genus, and still higher as these genera are divided amongst many families as opposed to a few. The genus, *Euphorbia* is found here to be the one with the most species (6), followed by *Heliotropium* (5), *Cleome*, *Crotalaria*, *Hedyotis, Indigofera*, *Ipomoea*, *Jasminum*, *Leucas, Mollugo, Phyllanthus* and *Sida* (4 species each). According to occurrence status, 172 species were found to be NO, 44 NR and 17 IN (Table 1 and 2). Among these, a large number of NO herbaceous, climbing species and a consistent number of NR species are now observed as a result of eco-restoration. The relative family (RF), genus (RG) and species (RS) values obtained are higher for herbs as compared to the climbing life form. Therefore, these findings suggest that the prevailing environmental conditions of the present study site favour the herbaceous taxa.

Species communities generally vary along ecological conditions, such as soil type and moisture content (Sollins 1998). Past phytosociological studies within the Pondicherry region have revealed that the micro-geographic variation in species richness and abundance particularly determine the species composition (Dabholkar 1962; Marlange and Meher-Homji 1965; Antony 1982). In this study *Striga densiflora* was found to be established well in association with grasses especially *Chrysopogon fulvus* in the red ferralitic soil. Dugje *et al*. (2006) stated that same species occupied 27 - 60% of millet fields in the savanna zones of northeast Nigeria. In the present eco-restoration site, *Boerhavia diffusa* and *Trianthema portulacastrum* flourish in clay soil with coarse sand. Sharma (1981) stated both of the above species show similar distribution in the semi-arid regions of India. In our study *Ammannia baccifera, Biophytum sensitivum*, *Phyla nodiflora*, *Polygala erioptera* and *P. javana* are found in stagnant water bodies or moist shady places. Interestingly, these are also reported in different parts of India (Kumar and Narain 2010; Murty and Venkaiah 2011) and other countries (Chmaitelly *et al*. 2009 and Harun-or-Rashid *et al.* 2009) in coastal and wetland habitats. We found that sandy-silt soil favours species like *Crotalaria medicaginea, Evolvulus alsinodes*, *Hedyotis* spp., *Mollugo* spp., and *Polycarpaea corymbosa*; *Enicostema axillare* grows well in alkaline soil; *Euphorbia rosea* and *Tiliacora acuminata* are common in *Casuarina equisetifolia* plantations and *Mangifera indica* groves respectively. Similar observation was done in the broad spectrum survey from the region of Tamil Nadu (Gamble and Fischer 1915 - 1935; Matthew 1981 - 1983). The analysis of species distribution patterns along environmental gradients is important for understanding the diversity and ecology of plants and species response to climate change, but detailed information are surprisingly scarce for the tropics (Wong and Whitmore 1970; Sollins 1998; Chaturvedi *et al*. 2011; Toledo *et al*. 2012). However, small scale regional studies, continuously over a long period, are needed to understand the dynamics of species distribution with reference to spatial and temporal factors.

Flowering and fruiting phenology

Nearly one third of the total observed species were flowering through the year; with most flowering having peaked in November and December. More rainfall, a shorter photoperiod and lower (mean maximum 30˚C) temperatures were recorded in this season. This study reveals that, of the observed species, most among the herbaceous life form do not show well defined vegetative and reproductive phenological phases. Although the peak flowering of most of the herbaceous species was observed after rainfall (personal observation), a considerable number of species did flower during the peak of summer. Several species initiated flowering from March onwards. Our findings on phenology are generally in agreement with those of Lang (1965); Sivaraj and Krishnamurthy (1989); Rivera and Borchert (2001); Ramirez (2002); Sridhar Reddy and Parthasarathy (2003). Climbing plants, mostly belonging to Asclepiadaceae, Menispermaceae and Vitaceae recorded flowering peak in the dry months between March and August. The results of the present study are in conformity with earlier ones obtained from other regions (Kephart 1987; Morellato and Leitao-Filho 1996). Seasonal variation in the availability of water and light should place physiological and thus evolutionary constraints on the phenologies of tropical forest plants (van Schaik *et al*. 1993; Wright 1996; Lieberman 1982; Borchert *et al*. 2004; Hamann 2004; Zimmerman *et al*. 2007).

Table 1. Binomials of Herbaceous (H) and Climbing (C) plants, their life forms (LF), occurrence status (OS), reproductive phenology and available Tamil vernacular names of the eco-restoration site.
Note: 01-12 =January-December; Acc. No= Accession Number.

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Acanthaceae						
Andrographis paniculata (Burm. f.) Wall. ex Nees	25348	H	NR	12 - 03; 07 - 09 (12 - 02)	03 - 12	Nila vaembu
Asystasia gangetica (L.) T. And.	25477	H	NR	12 - 03; 07 - 09 (12 - 02)	03 - 12	-
Barleria prionitis L.	25349	H	NO	11 - 01	12 - 03	Kaattu kanagaambaram
Blepharis maderaspatensis (L.) Heyne ex Roth	24869	H	NO	01 - 05	01 - 12	Kozhimookkan, Kooravaalchedi
Dipteracanthus patulus (Jacq.) Nees	25078	H	NO	12 - 02	12 - 03	-
Dipteracanthus prostratus (Poir.) Nees	25758	H	NR	01 - 12	01 - 12	Vedichchedi, Pottakanchi
Dyschoriste madurensis (Burm. f.) Kuntze	25782	H	NO	12 - 05 (03)	01 - 12	-
Indoneesiella echioides (L.) Sreemadh.	25017	H	NO	06 - 08	06 - 09	Gopuranthaangi
Justicia procumbens L.	25378	H	NO	01 - 12 (12 - 03)	03 - 09	Ottu pillu
Justicia prostrata (C. B. Clarke) Gamble	25133	H	NO	01 - 06; 10 - 12 (11 & 12)	01 - 06; 10 - 12	-
Lepidagathis cristata Willd.	25134	H	NO	01 - 10 (01 - 02)	05 - 10	Karappan poondu
Ruellia tuberosa L.	25141	H	NO	01 - 12	01 - 12	-
Agavaceae						
Sansevieria roxburghiana Schultes & Schultes f.	24890	H	NO	07 - 09	07 - 10	Marul, Mottamanjii
Aizoaceae						
Trianthema portulacastrum L.	24928	H	NR	03 - 11 (07 - 10)	05 - 12	Mookaratai
Trianthema triquetra Rottl. ex Willd.	25778	H	NO	11 - 03	01 - 12	Nilappasali
Amaranthaceae						
Achyranthes aspera L.	25761	H	NO	01 - 12 (01 - 03)	01 - 12	Naaiyuruvi
Aerva lanata (L.) Juss. ex Schultes	24851	H	NO	01 - 12 (12 - 03)	01 - 12	Koolappoo, Poolaippoo
Allmania nodiflora (L.) R. Br. ex Wight var. *nodiflora* Hook. f.	25194	H	NO	01 - 12 (01 - 04)	01 - 12	Vallikeerai, Kumuttikeerai
Alternanthera paronychioides A. St.	25792	H	NO	01 - 12 (11 - 01)	01 - 12	-
Alternanthera pungens Kunth.	25058	H	NO	08 - 12	08 - 12	Thevadiyaal mul, Ottara mul
Alternanthera sessilis (L.) R. Br. ex DC.	25196	H	IN	01 - 12 (11 - 01)	01 - 12	Ponnaankannikkeerai
Amaranthus spinosus L.	24945	H	NO	01 - 12 (11 & 12)	01 - 12	Mullukkeerai
Amaranthus viridis L.	25793	H	NO	01 - 12 (11 & 12)	01 - 12	Kuppaikkeerai
Celosia argentea L.	25019	H	NO	01 - 12	01 - 12	Makilikkeerai, Pannaippoo
Digera muricata (L.) Mart.	24949	H	NR	01 - 12 (11 - 03)	03 - 12	Sunnaambukkeerai
Gomphrena serrata L.	25112	H	NR	01 - 12 (01 - 03)	01 - 12	Vaadaamalligai
Psilotrichum nudum (Heyne ex Wall.) Moq.	25802	H	NO	10 - 02	01 - 12	-
Pupalia lappacea (L.) Juss	25092	H	NO	11 - 02 (01)	12 - 03	Adai-otti
Trichurus monsoniae (L. f.) Townsend	25162	H	NO	11 - 03 (02)	03 - 04	-
Apocynaceae						
Catharanthus pusillus (Murr.) G. Don	25218	H	NO	07 - 02 (11 - 01)	08 - 03	Milagai poondu, Paalaich chetthai
Catharanthus roseus (L.) G. Don	24921	H	IN	01 - 12	01 - 12	Sudukattu mallikai, Nithyakalyaani
Ichnocarpus frutescens (L.) R. Br.	25104	C	NO	06 - 10; 12 - 02 (02 & 12)	06 - 10; 12- 02	Manipilaan kodi, Udarkodi, Paravalli
Aristolochiaceae						
Aristolochia indica L.	25043	C	NO	12 - 02	01 - 12	Perumarunthukodi, Urikkalchedi
Asclepiadaceae						
Ceropegia juncea Roxb.	25350	C	NO	12 - 02	01 - 03	-

Table 1. *Continued.*

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Gymnema sylvestre (Retz.) R. Br. ex Schultes	25787	C	NO	08 - 03	10 - 03	Kannu minnayam kodi, Pasaani, Shirukurinja
Leptadenia reticulata (Retz.) Wight & Arn.	25784	C	NO	05 - 08	07 - 09	Palaikkodi, Paalai keerai
Pentatropis capensis (L. f.) Bullock	25777	C	NO	04 - 07	06 - 10	Uppili
Pergularia daemia (Forssk.) Chiov.	25755	C	NO	11 - 06 (01 - 03)	01 - 12	Vaelipparuthi
Sarcostemma intermedium Decne.	25128	C	NO	03 - 04; 09 - 12 (04 & 09)	03 - 04; 09 - 12	Kodikhalli
Tylophora indica (Burm. f.) Merr.	25030	C	NO	08 - 09 (08)	08 - 09	Nangilaippirattai
Wattakaka volubilis (L. f.) Stapf	24931	C	NO	03 - 04	04 - 06	Kurinjaa
Asteraceae						
Acanthospermum hispidum DC.	25090	H	NO	12 - 03 (12 - 02)	12 - 06	Kombumul, Mullichedi
Ageratum conyzoides L.	25763	H	NO	08 - 03 (01)	01 - 12	Vaadaichedi
Blainvillea acmella (L.) Philipson	24859	H	NR	12 - 01	01 - 05	-
Blumea lacera (Burm. f.) DC.	24971	H	NR	11 - 04 (01)	03 - 06	Thaevuppula, Navakkarandai
Blumea obliqua (L.) Druce	24904	H	NR	12 - 04 (01)	03 - 05	-
Eclipta prostrata (L.) L.	24872	H	NO	07 - 12 (11)	08 - 01	Karisilaanganni
Emilia sonchifolia (L.) DC.	25766	H	NO	10 - 04 (12 - 02)	02 - 05	-
Epaltes divaricata (L.) Cass.	24901	H	NR	12 - 03 (12 & 01)	03 - 05	-
Helianthus annuus L.	25086	H	IN	Cultivated	Cultivated	Sooriaganthi
Parthenium hysterophorus L.	25206	H	NO	01 - 12	01 - 12	-
Sphaeranthus indicus L.	25595	H	NO	12 - 03	03 - 06	Kottaikaranthai
Tridax procumbens L.	25137	H	NO	01 - 12	01 - 12	Kenathuppoondu, Vettukkaaya-thalai
Vernonia albicans DC.	25479	H	NO	01 - 05; 07 - 08 (01)	03 - 05; 08 - 11	-
Vernonia cinerea (L.) Less.	25158	H	NO	01 - 12 (01)	01 - 12	Mukuttipundu
Vernonia elaeagnifolia DC.	25786	C	IN	12 - 03	03 - 04	-
Vicoa indica (L.) DC.	25012	H	NO	05 - 09 (06)	06 - 10	-
Xanthium indicum Koen.	24996	H	NO	03 - 04	01 - 12	Ottarachedi
Bignoniaceae						
Tecomaria capensis (Thunb.) Spach	25803	C	IN	03 - 06	03 - 06	-
Boraginaceae						
Coldenia procumbens L.	25159	H	NO	04 - 08 (08)	04 - 08	Seruppadai
Heliotropium bracteatum R. Br.	24923	H	NO	02 - 03; 07 - 08	03 - 09	-
Heliotropium indicum L.	24963	H	NO	12 - 03; 07 - 09	01 - 12	Thael kodukku poondu
Heliotropium marifolium Retz.	24970	H	NO	04 - 09	04 - 09	-
Heliotropium supinum L.	24898	H	NO	03 - 04; 09 - 10 (09)	03 - 04; 09 - 10	-
Heliotropium zeylanicum (Burm. f.) Lam.	24979	H	NO	12 - 02; 08 - 09	01 - 12	-
Trichodesma indicum (L.) R. Br.	25474	H	NO	03 - 12	05 - 12	Kali thumbai, Kaasitthumbai
Caesalpiniaceae						
Cassia mimosoides L.	25772	H	NO	02 - 06	04 - 09	-
Cassia tora L.	25191	H	NR	11 - 02; 06 - 08	03; 06 - 08	Tagarai
Capparidaceae						
Capparis sepiaria L.	24990	C	NO	03 - 05	04 - 08	Thoratti, Karunjurai
Capparis zeylanica L.	25353	C	NO	02 - 04	04 - 06	Suduthorati, Adondai
Maerua oblongifolia (Forssk.) A. Rich.	25002	C	NO	06 - 08	06 - 09	Mochukkodi

Table 1. *Continued.*

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Caryophyllaceae						
Polycarpaea corymbosa (L.) Lam.	25472	H	NR	01 - 03	01 - 04	Palli poondu
Celastraceae						
Reissantia indica (Willd.) Halle	25152	C	NO	09 - 03; 05 - 07 (06)	09 - 03; 05 - 07	Odankodi, Morasarakodi
Cleomaceae						
Cleome aspera Koen. ex DC.	25774	H	NO	01 - 12	01 - 12	-
Cleome chelidonii L. f.	25759	H	NO	02 - 05	03 - 06	-
Cleome gynandra L.	24943	H	NR	03 - 09	03 - 09	Nalla velai
Cleome viscosa L.	25741	H	NO	01 - 12	01 - 12	Naivelai, Naikadugu
Combretaceae						
Combretum albidum G. Don	25789	C	NO	03 - 05	05 - 07	Odaikodi
Quisqualis indica L.	24918	C	IN	01 - 12	01 - 12	Irangoon mallikai
Commelinaceae						
Amischophacelus axillaris (L.) R. Rao & Kamm.	25773	H	NO	11 - 01 (12)	01	-
Commelina benghalensis L.	25740	H	NO	01 - 12 (08)	01 - 12	Kanavaazhai
Cyanotis tuberosa (Roxb.) Schultes & Schultes f.	25744	H	NO	01 - 12 (11 & 12)	01 - 12	-
Convolvulaceae						
Evolvulus alsinoides (L.) L.	25508	H	NO	01 - 12 (01 - 03)	06 - 12	Vishnukiranthi
Evolvulus nummularius (L.) L.	25788	H	NO	01 - 12 (11 - 01)	01 - 12	-
Hewittia sublobata (L. f.) Kuntze	25754	C	NR	12 - 03	01 - 05	-
Ipomoea indica (Burm. f.) Merr.	24914	C	IN	11 - 04	01 - 09	-
Ipomoea obscura (L.) Ker-Gawl.	25126	C	NR	01 - 12 (02 - 06)	01 - 12	Siruttalai
Ipomoea pes-tigridis L.	25106	C	NR	01 - 12 (11 - 03)	01 - 12	Pulichovadi, Punaikkirai
Ipomoea sepiaria Koen. ex Roxb.	25140	C	NR	01 - 12 (11 - 03)	01 - 12	Thazhakkodi
Jacquemontia paniculata (Burm. f.) Hall. f.	25798	C	IN	10 - 04 (12 - 02)	01 - 12	-
Merremia aegyptia (L.) Urban	25764	C	NO	03 - 07	04 - 08	-
Merremia emarginata (Burm. f.) Hall. f.	25116	C	NO	03 - 07	03 - 07	Yelikkaadhu Keerai
Merremia tridentata (L.) Hall. f.	24867	C	NO	01 - 12	01 - 12	-
Porana paniculata Roxb.	25202	C	IN	11 - 01 (12)	01 - 03	-
Cucurbitaceae						
Coccinia grandis (L.) Voigt	25339	C	NO	09 - 05 (12 - 03)	11 - 05	Kovai
Ctenolepis garcinii (Burm. f.) Clarke	24951	C	NO	11 - 02 (12)	01 - 04	-
Cucumis melo L.	25077	C	NO	09 - 03	02 - 07	-
Diplocyclos palmatus (L.) Jeffrey	25781	C	NO	01 - 03 (01)	03 - 05	-
Mukia maderaspatana (L.) M. Roem.	25122	C	NO	05 - 12	05 - 02	Mosumosukkai
Euphorbiaceae						
Acalypha indica L.	25199	H	NO	01 - 12	01 - 12	Kuppaimaeni
Acalypha lanceolata Willd.	25036	H	NO	01 - 04; 08	01 - 12	-
Croton bonplandianus Baill.	24858	H	NO	01 - 12 (04 - 06)	01 - 12	Reil Poondu
Euphorbia cyathophora Murr.	25795	H	NR	01 - 12	01 - 12	-
Euphorbia heyneana Spreng.	25779	H	NO	01 - 12	01 - 12	-
Euphorbia hirta L.	25605	H	NO	01 - 12	01 - 12	Amampatchaiarisi

Table 1. ***Continued.***

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Euphorbia rosea Retz.	24998	H	NO	03 - 05	05 - 06	-
Euphorbia serpens H. B. K.	24905	H	NR	03 - 05	05 - 06	-
Euphorbia thymifolia L.	25776	H	NO	04 - 06	05 - 07	Chinnamman pacharisi
Phyllanthus amarus Schum. & Thonn.	25743	H	NO	01 - 12 (11 - 02)	01 - 12	Kizhaa nelli
Phyllanthus debilis Klein ex Willd.	24954	H	NO	01 - 12 (11 - 02)	01 - 12	-
Phyllanthus maderaspatensis L.	25475	H	NO	01 - 12 (11 - 02)	01 - 12	-
Phyllanthus virgatus Forst. f.	24876	H	NO	06 - 11	01 - 12	-
Sauropus bacciformis (L.) Airy Shaw	25216	H	NO	03 - 08 (05 - 06)	01 - 12	-
Sebastiania chamaelea (L.) Muell.-Arg.	24880	H	NO	01 - 12 (11 - 01)	01 - 12	-
Tragia involucrata L.	25074	C	NO	01 - 12	01 - 12	Chenthatti
Fabaceae						
Abrus precatorius L.	25145	C	NO	11 - 05 (12)	01 - 12	Kundumani
Aeschynomene indica L.	25088	H	NR	01 - 03 (02)	01 - 12	Netti, Thakkapundu
Alysicarpus monilifer (L.) DC.	24973	H	NR	12 - 02	01 - 12	Kaasukkodi
Alysicarpus vaginalis (L.) DC.	25091	H	NR	11 - 02	11 - 03	-
Canavalia virosa (Roxb.) Wight & Arn.	25114	C	NO	01 - 12	01 - 12	Kaattu kizhi avarai, Kaattu thammattai
Clitoria ternatea L.	24975	C	NO	01 - 12	01 - 12	Sankupushpam
Crotalaria medicaginea Lam.	25738	H	NO	01 - 12 (12 & 01)	01 - 12	-
Crotalaria paniculata Willd.	25450	H	NR	01 - 07	01 - 08	-
Crotalaria retusa L.	24893	H	NR	08 - 03	08 - 03	-
Crotalaria verrucosa L.	25371	H	NR	01 - 12	01 - 12	Salangaichedi
Derris ovalifolia Benth.	24967	C	NO	04	05 - 07	-
Derris scandens (Roxb.) Benth.	25213	C	NO	09 - 10 (09)	09 - 11	Thekil
Desmodium dichotomum (Willd.) DC.	25756	H	NR	09 - 04	09 - 04	-
Desmodium laxiflorum DC.	24879	H	NR	12 - 04	01 - 06	Aadotti
Desmodium triflorum (L.) DC.	24994	H	NR	01 - 03; 08 - 12 (12 & 01)	01 - 05	-
Dicerma biarticulatum DC. subsp. *biarticulatum*	25768	H	NO	12 - 03	01 - 04	-
Dunbaria ferruginea Wight & Arn.	25794	C	NR	11 - 03	12 - 03	Masukkodi
Eleiotis monophylla (Burm. f.) DC.	25769	H	NO	09 - 01 (10 - 12)	01 - 12	-
Indigofera aspalathoides Vahl	25747	H	NR	10 - 05 (01)	10 - 07	Korandi, Sivanar vembu
Indigofera astragalina DC.	24884	H	NO	08 - 12	08 - 12	-
Indigofera linnaei Ali	25749	H	NR	01 - 12	01 - 12	Seppu nerinji
Indigofera trita L. f.	25748	H	NR	09 - 12	10 - 04	-
Macroptilium lathyroides (L.) Urban	25799	H	NO	03 - 07 (04)	04 - 10	-
Pseudarthria viscida (L.) Wight & Arn.	25742	C	NR	01 - 12	01 - 12	Kodi ottai
Rothia indica (L.) Druce	25343	H	NO	11 - 02 (12)	01 - 06	-
Stylosanthes fruticosa (Retz.) Alston	24870	H	NO	01 - 12 (12)	01 - 12	-
Tephrosia maxima Pers.	25101	H	NO	01 - 03; 08 - 09	03; 08	-
Vigna mungo (L.) Hepper	24864	C	NR	Cultivated	Cultivated	Ulundu
Vigna radiata (L.) Wilczek	25085	C	NR	Cultivated	Cultivated	-
Vigna trilobata (L.) Verdc.	25375	C	NR	11 - 04	11 - 04	Panipayir
Zornia diphylla (L.) Pers.	24857	H	NO	09 - 01 (10 - 12)	10 - 03	Pori karappaan thalai

Table 1. *Continued.*

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Gentianaceae						
Enicostema axillare (Lam.) Raynal	24906	H	NO	03 - 10 (03)	03 - 10	Vellaragu
Lamiaceae						
Anisomeles indica (L.) Kuntze	24972	H	NR	01 - 12 (11 - 02)	01 - 12	-
Geniosporum tenuiflorum (L.) Merr.	25770	H	NO	03 - 05	04 - 05	Nazel-nagai
Hyptis suaveolens (L.) Poit.	25751	H	NO	01 - 12 (02)	01 - 12	-
Leucas aspera (Willd.) Link	25115	H	NO	01 - 10 (06)	08 - 11	Thumbai
Leucas biflora (Vahl) R. Br.	25760	H	NO	01 - 07	01 - 12	-
Leucas indica (L.) R. Br. ex Vatke	24995	H	NO	08 - 11	08 - 11	Mosappullu
Leucas nutans Spreng.	25785	H	NO	09 - 03 (11)	01 - 12	-
Ocimum americanum L.	25110	H	NO	01 - 12 (01)	01 - 12	Naai thulasi
Ocimum tenuiflorum L.	25063	H	NO	03 - 11 (01)	08 - 11	Nalla thulasi
Orthosiphon thymiflorus (Roth) Sleensen	24968	H	NO	04 - 08 (05 - 06)	07 - 08	-
Liliaceae						
Gloriosa superba L.	25073	C	NO	10 - 11	11 - 03	Kalappai kizhangu, Kannuvalikkodi
Linaceae						
Hugonia mystax L.	25149	C	NO	01 - 06; 08 - 12 (04 - 05; 09 & 12)	05 - 07; 09 - 12	Mothirakanni
Loganiaceae						
Strychnos minor Dennst.	25765	C	NO	01 - 02	02 - 06	-
Lythraceae						
Ammannia baccifera L.	24903	H	NO	03	03 - 04	Kalluruvi, Nirumel neruppu
Malvaceae						
Hibiscus vitifolius L.	25144	H	NO	01 - 12 (04)	01 - 12	Manjal thutti
Malvastrum coromandelianum (L.) Garcke	24882	H	NO	01 - 12	01 - 12	-
Pavonia odorata Willd.	24852	H	NO	01 - 12	01 - 12	Peramutti
Pavonia procumbens (Wall. ex Wight & Arn.) Walp.	25800	H	NO	01 - 12	01 - 12	-
Pavonia zeylanica (L.) Cav.	25117	H	NO	01 - 03; 07 - 12	01 - 12	Thengai poondu
Sida acuta Burm. f.	25762	H	NO	01 - 12 (12)	01 - 12	Ariva-mooku Keerai
Sida cordata (Burm. f.) Borssum	25146	H	NO	01 - 12	01 - 12	Pazhampasi
Sida cordifolia L.	24875	H	NO	01 - 12	01 - 12	Nilatutti
Sida rhombifolia L.	25221	H	NO	01 - 12	01 - 12	Chithamutti
Menispermaceae						
Cissampelos pareira L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman	25087	C	NO	11 - 03	12 - 04	Appatta, Urikkakodi
Cocculus hirsutus (L.) Diels	24924	C	NO	03 - 05	04 - 06	Sirungattukodi
Cyclea peltata (Lam.) Hook. f. & Thoms.	25780	C	NO	03 - 06	04 - 07	Paachi
Tiliacora acuminata (Lam.) Hook. f. & Thoms.	25061	C	NO	07 - 08; 11 - 01	08; 11 & 12	Perungattukodi
Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thoms.	25783	C	NO	03 - 06	01 - 12	Chintil
Mimosaceae						
Mimosa pudica L.	25468	H	IN	02 - 11	07 - 12	Thottaar sinungi
Molluginaceae						
Gisekia pharnaceoides L.	25796	H	NO	01 - 12 (04 - 06)	01 - 12	Manal keerai
Mollugo disticha Ser.	25032	H	NO	01 - 12 (01 - 04)	01 - 12	-

Table 1. ***Continued.***

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Mollugo nudicaulis Lam.	25016	H	NO	01 - 12 (08 - 12)	01 - 12	Parpaadagam
Mollugo oppositifolia L.	25160	H	NO	01 - 12 (11 - 03)	01 - 12	Theruppoondu
Mollugo pentaphylla L.	25033	H	NO	01 - 12 (12 & 01)	01 - 12	Seerakappoondu
Nyctaginaceae						
Boerhavia diffusa L.	25120	H	NO	01 - 12 (11 - 01)	01 - 12	Mookkaratti
Boerhavia erecta L.	25059	H	NO	01 - 12 (11 & 12)	01 - 12	-
Nymphaeaceae						
Nelumbo nucifera Gaertn.	24997	H	IN	01 - 12	01 - 12	Chenthamarai
Oleaceae						
Jasminum angustifolium (L.) Willd. var. *angustifolium* Wight	25064	C	NO	10 - 12 (10)	01 - 12	Kaattumalligai
Jasminum angustifolium (L.) Willd. var. *sessiliflorum* (Vahl) P. S. Green	25192	C	NO	04 - 12 (04 - 08)	01 - 12	Kuruvilaangkodi
Jasminum auriculatum Vahl	24961	C	NO	07 - 11 (07)	01 - 12	Usimalligai, Mullai
Jasminum multiflorum (Burm. f.) Andr.	25757	C	NO	03 - 05	03 - 06	Malligai
Onagraceae						
Ludwigia perennis L.	25222	H	NO	11 - 04	03 - 06	-
Oxalidaceae						
Biophytum sensitivum (L.) DC.	25093	H	NO	11 - 12	12 - 01	-
Passifloraceae						
Passiflora edulis Sims	24911	C	IN	02 - 06	04 - 06	Thuraipadalai
Passiflora foetida L.	25345	C	NO	01 - 12	01 - 12	Mosukattaan
Pedaliaceae						
Sesamum indicum L.	25014	H	IN	06 - 08	07 - 12	Yellu
Periplocaceae						
Hemidesmus indicus (L.) R. Br.	25124	C	NO	12 - 02	03 - 05	Nannaari
Polygalaceae						
Polygala arvensis Willd.	25013	H	NO	01 - 12	01 - 12	-
Polygala erioptera DC.	25801	H	NO	03 - 07	06 - 11	Paruppu chedi
Polygonaceae						
Antigonon leptopus Hook. & Arn.	24981	C	IN	01 - 12 (01 & 10)	01 - 12	Kodi rose
Portulacaceae						
Portulaca oleracea L.	25223	H	NO	11 - 03	03 - 05	Vazhukkaikeerai
Portulaca pilosa L.	24974	H	NR	09 - 12	09 - 02	-
Portulaca quadrifida L.	25015	H	NR	01 - 08	01 - 08	Tharai pasalai
Rhamnaceae						
Scutia myrtina (Burm. f.) Kurz	24912	C	NO	03 - 06	01 - 12	Kokkimullu, Thuvadi
Ventilago madraspatana Gaertn.	25358	C	NO	12 - 03; 07 - 11	01 - 12	Veppanaangodi, Vempadam
Rubiaceae						
Hedyotis biflora L.	25771	H	NO	05 - 02	01 - 12	-
Hedyotis graminifolia L. f.	25797	H	NO	01 - 12 (01)	01 - 12	-
Hedyotis herbacea L.	25745	H	NO	01 - 12 (09)	01 - 12	Kattukotthamalli
Hedyotis puberula (G. Don) Arn. Pugill.	25470	H	NO	01 - 12 (01 - 12)	01 - 12	Saayavaer
Spermacoce hispida L.	25111	H	NO	01 - 12 (01)	01 - 12	Natthai choori

Table 1. ***Continued.***

FAMILY / BINOMIAL / AUTHOR CITATION	ACC.NO	LF	OS	FLOWERING	FRUITING	VERNACULAR NAME
Spermacoce ocymoides Burm. f.	25753	H	NO	01 - 12 (11 - 01)	01 - 12	-
Spermacoce pusilla Wall.	25775	H	NO	01 - 12 (11 - 01)	01 - 12	-
Rutaceae						
Toddalia asiatica (L.) Lam. var. *gracilis* Gamble	25205	C	NO	07 - 02 (11 - 01)	01 - 12	Sirusoori
Sapindaceae						
Cardiospermum halicacabum L. var. *microcarpum* Kunth	25750	C	NO	01 - 12	01 - 12	Mudukottan
Scrophulariaceae						
Lindernia ciliata (Colsm.) Pennell	25790	H	NR	06 - 08	07 - 09	-
Scoparia dulcis L.	24861	H	NO	05 - 11	01 - 12	Sarakkotthini
Striga densiflora (Benth.) Benth.	25767	H	NO	11 - 04	03 - 06	-
Solanaceae						
Physalis minima L.	25480	H	NR	01 - 12	01 - 12	-
Solanum surattense Burm. f.	24989	H	NR	01 - 12	01 - 12	Kandankathiri
Solanum trilobatum L.	25204	C	NR	10 - 03 (12)	10 - 05	Thudhuvaelai
Sterculiaceae						
Melochia corchorifolia L.	24862	H	IN	12 - 04 (12 & 01)	12 - 05	Punnakku thazhai
Melochia nodiflora Sw.	25746	H	NO	10 - 03 (11 - 12)	01 - 12	-
Waltheria indica L.	25739	H	NO	01 - 12 (11 - 01)	01 - 12	Sengalipoondu
Thunbergiaceae						
Thunbergia erecta (Benth.) T. And.	25069	H	IN	08 - 12	12 - 02	-
Tiliaceae						
Corchorus aestuans L.	24836	H	NO	01 - 06 (01)	03 - 06	-
Corchorus trilocularis L.	25075	H	NO	11 - 12 (12)	12 - 03	-
Triumfetta rhomboidea Jacq.	25752	H	NO	12 - 02	12 - 04	Ottarai
Triumfetta rotundifolia Lam.	25094	H	NO	12 - 03	12 - 04	Adayoti
Turneraceae						
Turnera ulmifolia L.	25224	H	IN	01 - 12	01 - 12	-
Verbenaceae						
Phyla nodiflora (L.) Greene	25109	H	NO	03 - 06 (05 - 06)	05 - 07	Poduthalai
Stachytarpheta jamaicensis (L.) Vahl	25737	H	NR	01 - 12	01 - 12	Seemainaayuruvi
Violaceae						
Hybanthus enneaspermus (L.) F. V. Muell.	24902	H	NO	01 - 12 (03 & 08)	01 - 12	Orilai thamarai
Vitaceae						
Ampelocissus tomentosa (Heyne ex Roth) Planch.	25210	C	NO	10 - 12 (11)	11 - 01	-
Cissus quadrangularis L.	25181	C	NO	05 - 09	01 - 12	Pirandai
Cissus vitiginea L.	24992	C	NO	05 - 09 (06 - 07)	06 - 11	-
Zygophyllaceae						
Tribulus terrestris L.	25138	H	NO	01 - 12	03 - 12	Nerunji

Long term surface data and remote sensing measurements indicated that plant phenology has been advanced by 2 - 3 days in spring and delayed by 0.3 - 1.6 days in autumn per decade in the past 30 - 80 years, resulting in extension of the growing season (Parmesan and Yohe 2003). In our two year study, it was observed that some species were flowering twice a year. *Andrographis paniculata, Heliotropium bracteatum, H. indicum, H. zeylanicum* and *Ventilago maderaspatana* were blooming in July - November and December - March. The studies of Yadav and Yadav (2008) reported a similar observation. The peak flowering season of *Capparis sepiaria, Cissus quadrangularis, C. vitiginea, Cocculus hirsutus, Derris ovalifolia, Enicostema axillare, Euphorbia rosea, E. serpens, Indoneesiella echioides, Leucas aspera, Merremia emarginata, Orthosiphon thymiflorus, Phyla nodiflora, Polygala erioptera,* and *Wattakaka volubilis* was found to be summer (April - June). Selwyn and Parthasarathy (2006) Kumar and Narain (2010) reported similar phenology in low land areas; whereas it was winter (November - January) for *Abrus precatorius, Biophytum sensitivum, Cissampelos pareira, Crotalaria medicaginea, Cyanotis tuberosa* and *Desmodium triflorum* (Table 1). Morellato and Leitao-Filho (1996) and Selwyn and Parthasarathy (2006) also found parallel findings. Long-term monitoring and studies are essential to validate the extent of the growing season for individual species. About 50% of the species studied were found to be fruiting through the year. Demarcation between flowering and fruiting phenology is more obscure in the herbaceous than the climbing life form. Further studies on fruits and seed dispersal are proposed to be carried out.

Conclusion

The present study reports the diversity and reproductive phenology of herbs and climbing plants of an eco-restoration site. 233 species belonging to 157 genera and 56 families were enumerated. It reveals that 172 species are NO and 44 are NR. Among them, *Aristolochia indica*, *Derris ovalifolia* and *Sarcostemma intermedium* are rare and endangered. The rare medicinal plants, *Enicostema axillare* and *Gloriosa superba* are well established in the site. *Cyclea peltata, Digera muricata, Euphorbia serpens, Gisekia pharnaceoides, Heliotropium zeylanicum, Leucas biflora, Spermacoce pusilla* and *Trianthema triquetra* are reported for the first time in this area. About 50% of the total species reported by earlier works from the Southern Coromandel Coastal vegetation occur in our study site. Phenologically, the distinction between flowering and fruiting phenomena remained less in herbs as compared to climbers. This check list provides important baseline information on the successful plants that may be introduced in a damaged ecosystem or barren area for expanding the green cover in comparable regions. It will serve as a genetic resource for future references since there is a threat of genetic erosion due to global warming and climate change. As nearly 50% of the dry lands of India are devoid of forest, they can be reclaimed if treated properly by eco-restoration to develop a sustainable ecosystem and help to deal with the environmental crisis and enhance natural resources.

Table 2. A summary of the floristic distribution with reference to the life forms in the eco-restoration site..

Life form	Number of families (F)	Number of genus (G)	Relative family	Dicot G	Dicot S	Monocot F	Monocot G	Monocot S	Number of species (S)	Relative species	Relative genus	Genus/ Family ratio	Species/ Genus ratio	Occurrence status NO	Occurrence status NR	Occurrence status IN
Herbaceous & Climbing plants	56	157	-	152	228	3	5	5	233	-	-	2.80	1.48	172	44	17
Herbaceous	37	105	0.66	101	161	2	4	4	165	0.71	0.67	2.84	1.57	122	34	9
Climbing plants	25	54	0.45	53	67	1	1	1	68	0.29	0.34	2.16	1.26	50	10	8

Note: NO= Naturally Occurring, NR= Naturally Regenerated and IN= Introduced

Table 3. A comparative compilation of various vegetation studies in the Puducherry and southern Coromandel Coastal region. Note: Numbers in bold within bracket refer to species found in the present study, where overall G/F= 2.80 and S/G= 1.48

Author and published Year	Total number of species explored	Taxonomic Diversity	Number of Herbaceous life form	Number of Climbing life form	Study site
Parthasarathy and Karthikeyan 1997	54 species, 47 genera and 31 families	G/F=1.52. S/G=1.15	-	20 (**9**)	TDEF (Kuzhanthaikuppam and Thirumanikkuzhi)
Sridhar Reddy and Parthasarathy 2003	39 species, 34 genera and 24 families	G/F=1.42. S/G=1.15	-	39 (**17**)	TDEF (Oorani, Arasadikuppam, Kuzhanthaikuppam and Puthupet)
Kadavul *et al.* 2004a	332 species, 261 genera and 79 families	G/F=3.30. S/G=1.27	147 (**131**)	57 (**36**)	Puducherry surroundings
Kadavul *et al.* 2004b	184 species, 135 genera and 48 families	G/F=2.81. S/G=1.36	184 (**94**)	-	Puducherry surroundings
Ramanujam *et al.* 2007	423 species, 322 genera and 93 families	G/F=3.46. S/G=1.31	146 (**87**)	80 (**46**)	37 Sacred Groves
Parthasarathy *et al.* 2008	149 species, 122 genera and 49 families	G/F=2.49. S/G=1.22	-	47 (**23**)	75 TDEF sites
Padmavathy *et al.* 2010	41 species, 35 genera and 20 families	G/F=1.75. S/G=1.17	17 (**13**)	3	Nallavadu Village (Coastal Sand Dune)
Udayakumar and Parthasarathy 2010	312 species, 251 genera and 80 families	G/F=3.14. S/G=1.24	105 (**58**)	56 (**26**)	75 TDEF sites

Andrographis paniculata

Asystasia gangetica

Barleria prionitis

Blepharis maderaspatensis

Dipteracanthus patulus

Dipteracanthus prostratus

FIGURE 4. Species belonging to Acanthaceae, photos by R. Ponnuchamy.

Dyschoriste madurensis

Indoneesiella echioides

Lepidagathis cristata

Ruellia tuberosa

Sansevieria roxburghiana

Trianthema portulacastrum

Figure 5. Species belonging to Acanthaceae, Agavaceae and Aizoaceae, photos by R. Ponnuchamy.

Trianthema triquetra

Achyranthes aspera

Aerva lanata

Allmania nodiflora var. *nodiflora*

Alternanthera paronychioides

Alternanthera pungens

Figure 6. Species belonging to Aizoaceae and Amaranthaceae, photos by R. Ponnuchamy.

Alternanthera sessilis

Amaranthus spinosus

Amaranthus viridis

Celosia argentea

Digera muricata

Gomphrena serrata

Figure 7. Species belonging to Amaranthaceae, photos by R. Ponnuchamy.

Pupalia lappacea

Trichurus monsoniae

Catharanthus pusillus

Catharanthus roseus

Ichnocarpus frutescens

Aristolochia indica

FIGURE 8. Species belonging to Amaranthaceae, Apocynaceae and Aristolochiaceae, photos by R. Ponnuchamy.

Leptadenia reticulata

Pentatropis capensis

Pergularia daemia

Sarcostemma intermedium

Tylophora indica

Wattakaka volubilis

Figure 9. Species belonging to Asclepiadaceae, photos by R. Ponnuchamy.

Acanthospermum hispidum

Ageratum conyzoides

Blainvillea acmella

Blumea obliqua

Eclipta prostrata

Emilia sonchifolia

Figure 10. Species belonging to Asteraceae, photos by R. Ponnuchamy.

Epaltes divaricata

Helianthus annuus

Parthenium hysterophorus

Tridax procumbens

Vernonia albicans

Vernonia cinerea

Figure 11. Species belonging to Asteraceae, photos by R. Ponnuchamy.

Vernonia elaeagnifolia

Vicoa indica

Xanthium indicum

Tecomaria capensis

Coldenia procumbens

Heliotropium indicum

Figure 12. Species belonging to Asteraceae, Bignoniaceae and Boraginaceae, photos by R. Ponnuchamy.

Heliotropium marifolium

Heliotropium supinum

Heliotropium zeylanicum

Trichodesma indicum

Cassia mimosoides

Cassia tora

FIGURE 13. Species belonging to Boraginaceae and Caesalpiniaceae, photos by R. Ponnuchamy.

Capparis sepiaria

Capparis zeylanica

Maerua oblongifolia

Polycarpaea corymbosa

Reissantia indica

Cleome aspera

FIGURE 14. Species belonging to Capparidaceae, Caryophyllaceae, Celastraceae and Cleomaceae, photos by R. Ponnuchamy.

Cleome chelidonii

Cleome gynandra

Cleome viscosa

Combretum albidum

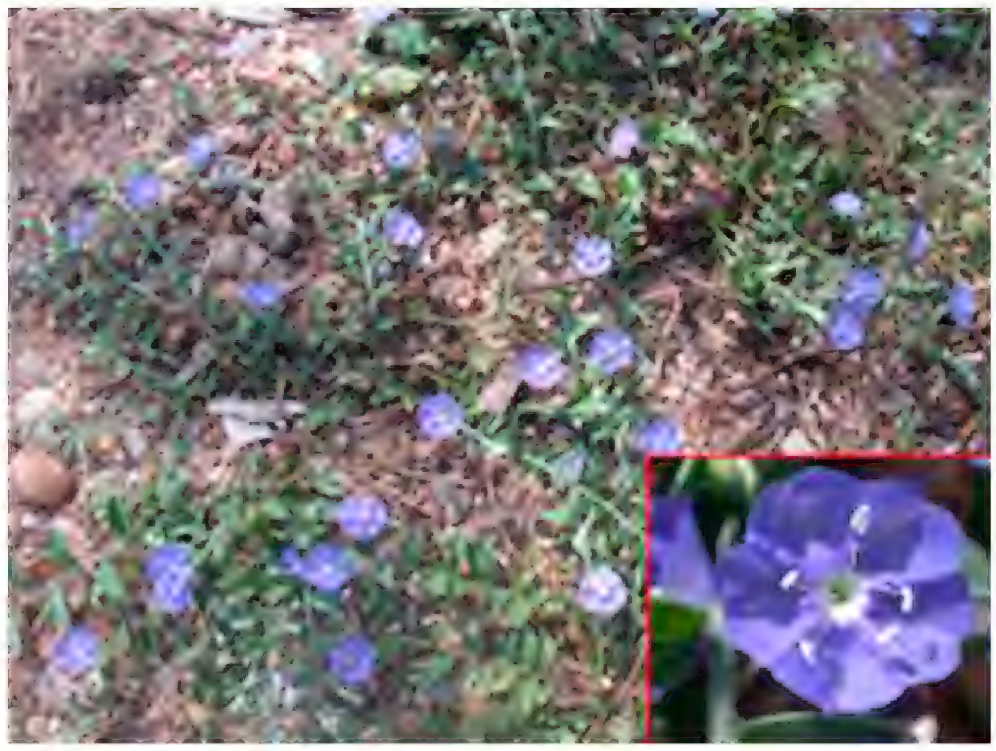
Quisqualis indica

Amischophacelus axillaris

FIGURE 15. Species belonging to Cleomaceae, Combretaceae and Commelinaceae, photos by R. Ponnuchamy.

Commelina benghalensis

Cyanotis tuberosa



Evolvulus alsinoides

Evolvulus nummularius

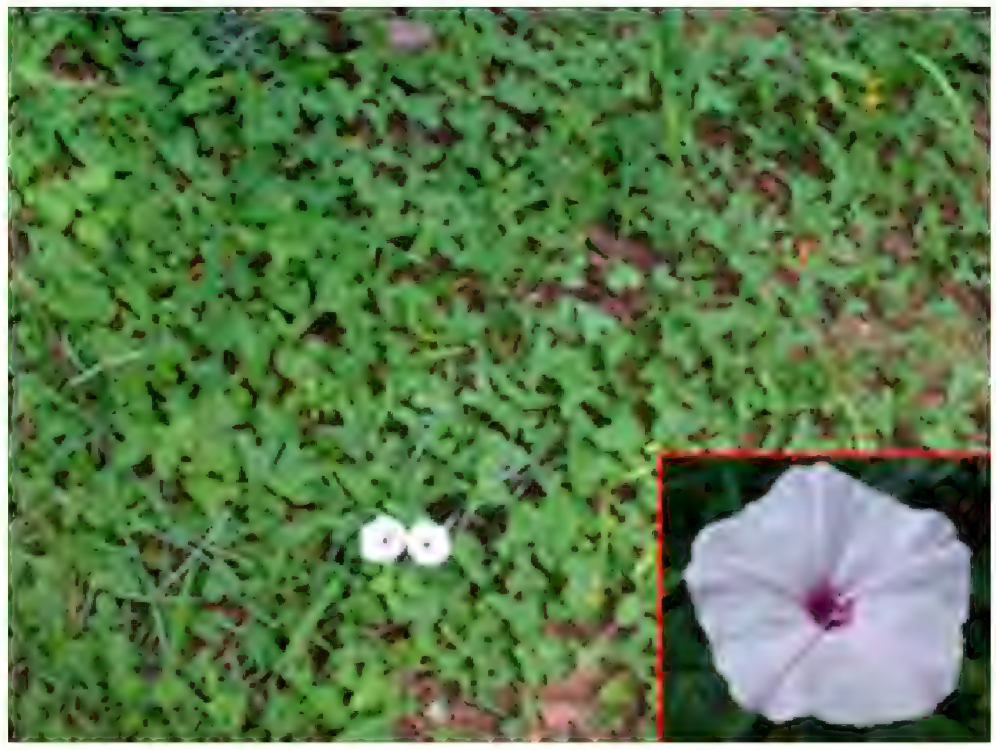
Hewittia sublobata

Ipomoea indica

FIGURE 16. Species belonging to Commelinaceae and Convolvulaceae, photos by R. Ponnuchamy.

Ipomoea obscura

Ipomoea pes-tigridis



Ipomoea sepiaria

Jacquemontia paniculata

Merremia emarginata

Merremia tridentata

Figure 17. Species belonging to Convolvulaceae, photos by R. Ponnuchamy.

Porana paniculata

Coccinia grandis

Cucumis melo

Diplocyclos palmatus

Mukia maderaspatana

Acalypha indica

FIGURE 18. Species belonging to Convolvulaceae, Cucurbitaceae and Euphorbiaceae, photos by R. Ponnuchamy.

Acalypha lanceolata

Croton bonplandianus

Euphorbia cyathophora

Euphorbia hirta

Euphorbia rosea

Euphorbia serpens

Figure 19. Species belonging to Euphorbiaceae, photos by R. Ponnuchamy.

Euphorbia thymifolia

Phyllanthus amarus

Phyllanthus debilis

Phyllanthus maderaspatensis

Phyllanthus virgatus

Sauropus bacciformis

Figure 20. Species belonging to Euphorbiaceae, photos by R. Ponnuchamy.

Sebastiania chamaelea

Tragia involucrata

Abrus precatorius

Aeschynomene indica

Alysicarpus monilifer

Canavalia virosa

Figure 21. Species belonging to Euphorbiaceae and Fabaceae, photos by R. Ponnuchamy.

Clitoria ternatea

Crotalaria medicaginea

Crotalaria retusa

Crotalaria verrucosa

Derris ovalifolia

Derris scandens

Figure 22. Species belonging to Fabaceae, photos by R. Ponnuchamy.

Desmodium laxiflorum

Desmodium triflorum

Dicerma biarticulatum subsp. *biarticulatum*

Eleiotis monophylla

Indigofera aspalathoides

Indigofera astragalina

FIGURE 23. Species belonging to Fabaceae, photos by R. Ponnuchamy.

Indigofera linnaei

Indigofera trita

Pseudarthria viscida

Rothia indica

Stylosanthes fruticosa

Tephrosia maxima

FIGURE 24. Species belonging to Fabaceae, photos by R. Ponnuchamy.

Zornia diphylla

Enicostema axillare

Anisomeles indica

Geniosporum tenuiflorum

Hyptis suaveolens

Leucas aspera

FIGURE 25. Species belonging to Fabaceae, Gentianaceae and Lamiaceae, photos by R. Ponnuchamy.

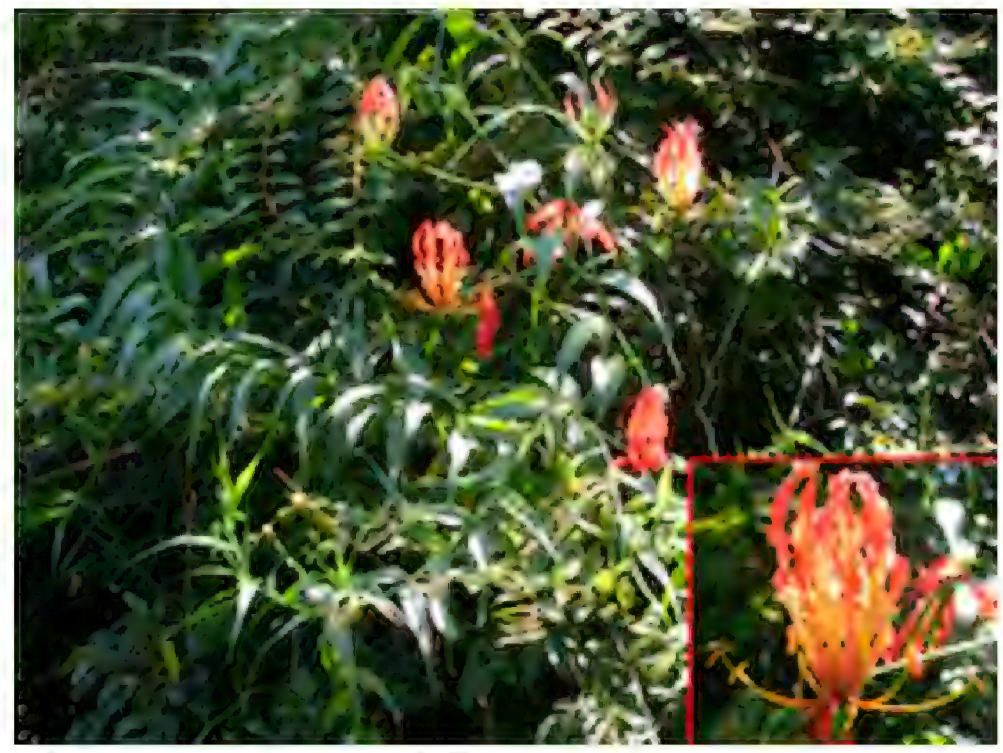
Leucas indica

Leucas nutans

Ocimum americanum

Ocimum tenuiflorum

Orthosiphon thymiflorus



Gloriosa superba

FIGURE 26. Species belonging to Lamiaceae and Liliaceae, photos by R. Ponnuchamy.

Hugonia mystax

Strychnos minor

Ammannia baccifera

Hibiscus vitifolius

Pavonia odorata

Pavonia procumbens

Figure 27. Species belonging to Linaceae, Loganiaceae, Lythraceae and Malvaceae, photos by R. Ponnuchamy.

Pavonia zeylanica

Sida acuta

Sida cordata

Sida cordifolia

Sida rhombifolia

Cissampelos pareira var. *hirsuta*

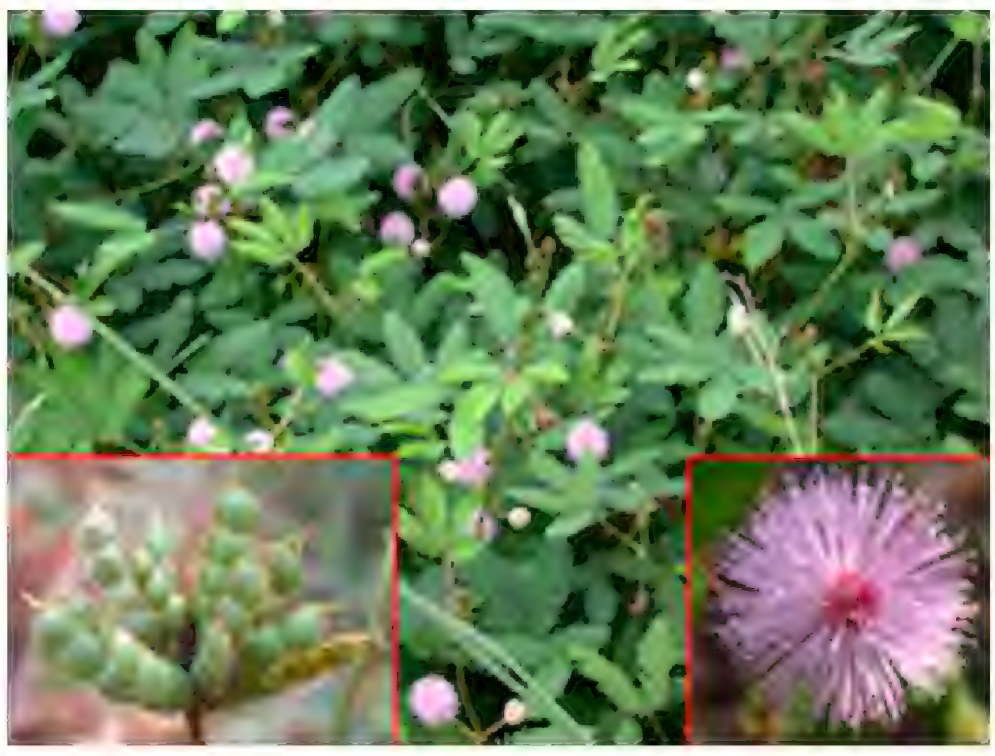
Figure 28. Species belonging to Malvaceae and Menispermaceae, photos by R. Ponnuchamy.

Cocculus hirsutus

Cyclea peltata

Tiliacora acuminata

Tinospora cordifolia



Mimosa pudica

Gisekia pharnaceoides

Figure 29. Species belonging to Menispermaceae, Mimosaceae and Molluginaceae, photos by R. Ponnuchamy.

Mollugo disticha

Mollugo nudicaulis

Mollugo oppositifolia

Mollugo pentaphylla

Boerhavia diffusa

Nelumbo nucifera

FIGURE 30. Species belonging to Molluginaceae, Nyctaginaceae and Nymphaeaceae, photos by R. Ponnuchamy.

Biophytum sensitivum

Passiflora foetida

Sesamum indicum

Hemidesmus indicus

Antigonon leptopus

Scutia myrtina

FIGURE 31. Species belonging to Oxalidaceae, Passifloraceae, Pedaliaceae, Periplocaceae, Polygonaceae and Rhamnaceae, photos by R. Ponnuchamy.

Hedyotis biflora

Hedyotis puberula

Spermacoce hispida

Spermacoce ocymoides

Spermacoce pusilla

Toddalia asiatica

FIGURE 32. Species belonging to Rubiaceae and Rutaceae, photos by R. Ponnuchamy.

Cardiospermum halicacabum var. microcarpum

Scoparia dulcis

Striga densiflora

Physalis minima

Solanum surattense

Solanum trilobatum

FIGURE 33. Species belonging to Sapindaceae, Scrophulariaceae and Solanaceae, photos by R. Ponnuchamy.

Melochia corchorifolia

Melochia nodiflora

Waltheria indica

Phyla nodiflora

Stachytarpheta jamaicensis

Hybanthus enneaspermus

FIGURE 34. Species belonging to Sterculiaceae, Verbenaceae and Violaceae, photos by R. Ponnuchamy.

Ampelocissus tomentosa

Cissus quadrangularis

Cissus vitiginea

Tribulus terrestris

Figure 35. Species belonging to Vitaceae and Zygophyllaceae, photos by R. Ponnuchamy.

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